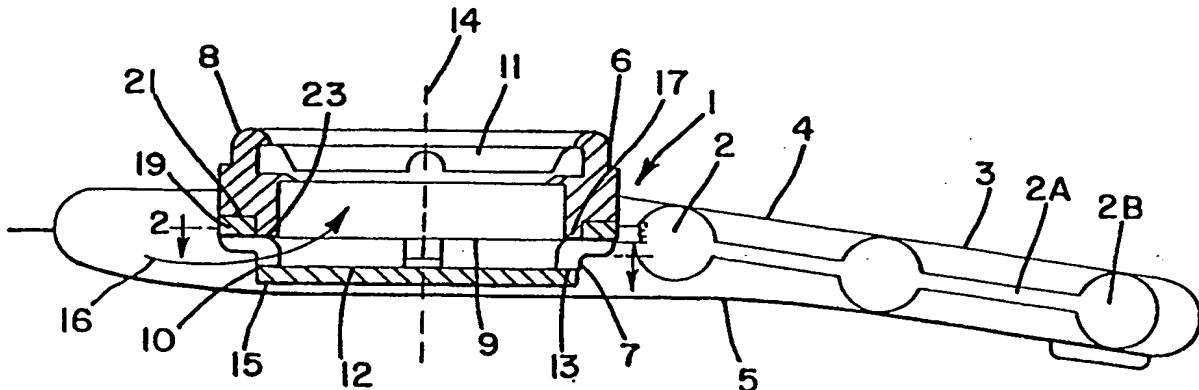


Cited by Appl.  
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>6</sup> : F02M 37/22		A1	(11) International Publication Number: <b>WO 97/46800</b> (43) International Publication Date: 11 December 1997 (11.12.97)
(21) International Application Number:	PCT/IB97/00640	(81) Designated States: BR, CA, JP, KR, MX, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).	
(22) International Filing Date:	4 June 1997 (04.06.97)		
(30) Priority Data:	296 09 750.0 4 June 1996 (04.06.96) DE	Published	<i>With international search report.</i>
(71) Applicant:	FILTERTEK, S.A. [FR/FR]; Z.A. du Pré de la Dame-Jeanne, Boite postale 11, F-60128 Plailly (FR).		
(72) Inventor:	CHIGA, Antonio; 4, allée Messire Jean, F-77230 Dammarin-en-Goële (FR).		

## (54) Title: FUEL FILTER



## (57) Abstract

A fuel filter has a supporting body comprising plastic which is enclosed in a filter fabric and which has a pump connection neck positioned on the top side of the filter. The pump connection neck, with its bottom end extending in close proximity to the bottom of the filter, has an inlet opening. The inlet opening is surrounded by a number of supporting feet. According to the invention, the inlet opening (9) is covered by a plastic disk (12) extending normal to the axis (14) of the pump connection neck (6). The plastic disk (12) is connected with the supporting feet (10) in such a way that the filter fuel flows into the pump connection neck (6) in a radial direction.

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

- 1 -

## FUEL FILTER

### FIELD OF THE INVENTION

5

The invention relates to a fuel filter having a supporting body comprising plastic which is enclosed in a filter fabric, wherein on the top side of the filter there is positioned a pump connection neck which has a bottom end extending close to the bottom of the filter and which has an inlet opening, wherein the inlet opening is surrounded by a plurality of supporting feet.

### BACKGROUND OF THE INVENTION

15

A fuel filter of the above kind, for example, is disclosed in the DE 39 14 938 C1.

Fuel filters of this kind are characterized by a 20 extremely simple construction and are especially useful to be mounted within a fuel tank of motor driven vehicles. The filter function is performed by the filter fabric. The supporting body maintains the distance between the bottom side and the top side of the filter 25 fabric, forming a filter body, because otherwise both sides could partially contact each other, which would decrease the available filter area.

Fuel filters of this kind, in the most cases, are 30 closely mounted to a conveying means, especially a fuel pump, which is also positioned in the fuel tank. In installations of this kind, the filter is connected to the pump connection neck, either directly or by a suction line, and therefore forms a body which can vibrate and 35 transfer vibrations during the operation of the pump or other conveying means. In many cases the transfer of such vibrations creates undesired sounds. In connection

- 2 -

with the filters of DE 39 14 938 C1, attempts have been made to reduce such sounds by a special design of the supporting body. However, these attempts were not completely successful.

5

SUMMARY OF THE INVENTION

A fuel filter has been developed which has reduced the undesired sound during the operation of the filter.

10 The fuel filter comprises a) a supporting body comprising plastic; b) a filter fabric enclosing said supporting body; c) a pump connection neck positioned on the top side of the filter, the pump connection neck having an inlet opening surrounded by a plurality of supporting feet having spaces between them; and d) a plastic plate covering the inlet opening such that filtered fluid flows radially into the inlet of the pump connection neck through spaces between the supporting feet.

20 According to one aspect of the invention, the inlet opening is completely covered by a plastic disk extending normal to the axis of the pump connection neck. The disk is connected with the bottom ends of the supporting feet such that the filtered fuel can flow into the pump connection neck only in a radial direction.

25 This feature ensures a radial flow of the filtered fuel into the pump connection neck. This results in the advantage that vibrations to the fuel tank are reduced, which had been the case when the fuel was flowing in a perpendicular or axial direction through the pump connection neck. Therefore, by this invention a substantial reduction of the undesired sounds is achieved.

35

The preferred plastic disk corresponds in diameter to the cross-section of the suction neck of the pump, is

- 3 -

circular, and should extend parallel to the bottom of the filter.

It is preferred that the side of the plastic disk  
5 facing the bottom of the filter have a smooth surface so  
as to prevent the filter fabric from being damaged in  
this area should the filter fabric contact the plastic  
disk.

10 In one embodiment of the invention, the pump  
connection neck is formed as one monolithic piece with  
the supporting body and with the supporting feet.  
Preferably the pump connection neck, too, is in one piece  
with the plastic disk. As a result, preferably the  
15 entire unit is formed as one unitary member.

In another preferred embodiment of the present  
invention, the pump connection neck is formed as one  
piece with the supporting body and the supporting feet  
20 are formed as one piece with the plastic disk. The  
separate one-piece feet and disk member is then connected  
with the pump connection neck. This embodiment avoids  
the need for complicated undercuts in the molds used to  
mold the filter parts.

25 Preferably, this embodiment can be further improved  
by molding the top ends of the supporting feet in one  
piece with an annular body which is received in an  
annular groove in the bottom edge of the pump connection  
30 neck.

In the embodiment with separate pieces, the  
connection of the pump connection neck with the other  
member is preferably made by bonding or welding,  
35 especially by ultrasonic welding.

- 4 -

In an especially preferred embodiment of the present invention, the pump connection neck is insert injection-molded onto the filter fabric.

5 Examples of the invention are shown in the drawings and in the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

10 Fig. 1 a schematic side view in cross-section of a preferred embodiment of the fuel filter according to the invention;

15 Fig. 2 a cross-sectional view taken along line 2-2 in Fig. 1.

Fig. 3 is a top plan view of second preferred embodiment of the present invention.

20 Fig. 4 is a cross-sectional view taken along line 4-4 of Fig. 3.

DETAILED DESCRIPTION OF THE DRAWINGS AND OF THE PREFERRED EMBODIMENTS

25 As shown in Figs. 1 and 2, one preferred fuel filter 1 of the present invention contains a supporting body 2 consisting of plastic. Supporting body 2 preferably has a typical construction consisting of bars 2A having spreader elements 2B. The supporting body 2 is enclosed in a plastic filter fabric 3 which performs the filtration function.

35 The top side 4 of the filter 1 is provided with a pump connection neck 6 of usual construction. Its bottom end 7 extends closely to the bottom 5 of the filter 1. As shown in FIG. 1, the pump connection neck 6 is

- 5 -

preferably in one piece with the supporting body 2 and is preferably directly injection molded onto the filter fabric 3. Details of this kind of construction are described in EP Patent Publication No. 0 400 170 B1,  
5 incorporated herein by reference.

The pump connection neck 6 has an inlet opening 9 for the filtered fuel, which is surrounded by a plurality of supporting feet 10. The fuel filter 1 is connected by  
10 its pump connection to the suction side of a fuel pump or other conveying means (not shown). The filter and pump are then positioned in the interior of a fuel tank of a motor driven vehicle (not shown). The fuel surrounding the filter fabric 3 reaches the inlet opening 9 via the  
15 filter fabric 3. Dirt particles and the like are separated by the filter fabric 3.

According to this first preferred embodiment of the invention, the inlet opening 9 is completely covered by a  
20 plastic disk 12 extending normal to the axis 14 of the pump connection neck 6. The disk 2 is connected with the bottom ends 13 of the supporting feet 10. By this measure the axial flow of the fuel from the inlet opening 9 to the suction side 11 is prevented. The filtered fuel  
25 therefore exclusively flows radially into the pump connection neck 6 through the spaces between the feet 10. The flow of the fuel is shown by the arrow 16.

As further can be seen from Fig. 1, the plastic disk  
30 12 extends parallel to the bottom of the filter 1. The side of the plastic disk 12 facing the bottom 5 of the filter 1 has a smooth surface.

In the preferred embodiment shown in Figs. 1 and 2,  
35 the supporting feet 10 are performed as a separate one-piece member 15 with the plastic disk 12. The one-piece member 15 is then connected with the pump connection neck

- 16 -

6. The top ends 17 of the supporting feet 10 are connected with an annular body 19. The annular body 19 is received by an annular groove 21 in the bottom edge of the pump connection neck 6 and connected thereto either 5 by glueing or preferably by ultrasonic welding.

In a different embodiment of the invention, however, the entire unit which is enclosed in the filter fabric 3 can be performed as one unitary piece. In this 10 embodiment the pump connection neck 6 with the supporting body 2, the supporting feet 10 and the plastic disk 12 are formed as one monolithic member, which is also preferably directly injection molded onto the filter fabric 3.

15

Further modifications or alternations of the invention are obvious to the expert in this field and are included in the basic idea of the invention, which is to 20 interrupt an axial flow of the filtered fuel into the pump connection neck 6.

The filter fabric 3 is preferably made from a polyamide, although other polymers that are resistant to fuels and common fuel additives can also be used. The 25 filter fabric could be monofilament or multifilament woven filtration medias; for example, square weave polymer monofilament; plain, reverse Dutch weave nylon, Saran, polyester or other polymer monofilament; or twill weave monofilament. The pump connection neck 6, 30 supporting body 2 and disk 12 are preferably polyacetals, although other thermal plastics compatible with fuel and additives may be used.

A second preferred embodiment of the invention is 35 shown in Figs. 3 and 4. In this embodiment, the fuel filter 20 is made from top and bottom webs of filtration media 22, 23 sealed together around the filter perimeter

- 7 -

24, and also encloses a plastic supporting body 26 formed as a monolithic unit with the pump connection neck 28 and its supporting feet 32 and the plate 34 attached at the bottom of the feet 32. Also, the filtration media 22 is 5 insert injection molded with the pump connection neck 28. The plate 34 is in the shape of a disk, but is slightly smaller than the diameter of the inlet opening of the pump connection neck. The fluid flow into the pump connection neck, shown by arrows 37, is therefore still 10 predominantly radially, through the spaces 36 between the supporting feet 32.

Filtration media useful in the invention can be of many different types, and is still being evaluated. One 15 preferred filtration media 22 is a depth filtration media which is laminated from four layers. The top, outer layer is a 132 micron woven nylon 6/6 screen. The next layer is a layer of 0.5 ounce/yd<sup>2</sup> (OSY) spun bonded nylon 6/6. The third layer is of melt blown nylon 6. The 20 fourth layer is 0.5 OSY spun bonded nylon 6/6. The materials are embossed together into a laminate. The melt blown nylon provides most of the filtration performance. The preferred melt blown layer has a Frazier Air Permeability of 110 to 225 ft<sup>3</sup>/ft<sup>2</sup>/min., a 25 basis weight of 50-80 grams/m<sup>2</sup>, and is made of fibers having a diameter of 2-10 micrometers, with a mean diameter of 4 micrometers.

The filter 20 is preferably constructed by punching 30 out a circular hole in the media 22 and insert injection molding the monolithic pump connection neck 28/ supporting body 26/ supporting feet 32/ plate 34 component onto the media. Next a bottom layer 23 of media 35 is welded at perimeter 24 to the media 22 injection molded to the pump connection neck, and excess media trimmed.

- 8 -

It should be appreciated that the apparatus of the present invention is capable of being incorporated in the form of a variety of embodiments, only a few of which have been illustrated and described above. The invention 5 may be embodied in other forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive, and the scope of the invention is, therefore, indicated by the appended claims 10 rather than by the foregoing description. All changes which come within the meaning and range of equivalency of the claims are to be embraced within their scope.

## CLAIMS:

1. A fuel filter having a supporting body comprising plastic, which is enclosed in a filter fabric and has a pump connection neck positioned on the top side of the filter, the lower end of the pump connection neck extending in close proximity to the bottom of the filter, said pump connection neck having an inlet opening, wherein the inlet opening is surrounded by a plurality of supporting feet, characterized in that the inlet opening is completely covered by a plastic disk extending normal to the axis of the pump connection with the bottom ends of the supporting feet, such that the filtered fuel can only flow radially into the pump connection neck.

15

2. The fuel filter according to claim 1, characterized in that the plastic disk extends parallel to the bottom of the filter.

20

3. The fuel filter according to claim 1, characterized in that the side of the plastic disk facing the bottom of the filter has a smooth surface.

25

4. The fuel filter according to claim 1, characterized in that the pump connection neck is performed as one unitary piece with the supporting body and the supporting feet.

30

5. The fuel filter according to claim 4, characterized in that the pump connection neck is performed as one unitary piece with the plastic disk.

35

6. The fuel filter according to claim 1, characterized in that the pump connection neck is unitary with the supporting body, and the supporting feet and the

- 10 -

plastic disk are formed as a separate unitary member which is fixed to the pump connection neck.

7. The fuel filter according to claim 6,  
5 characterized in that the top ends of the supporting feet are connected in one piece with an annular body, which is received in an annular groove provided in the bottom edge of the pump connection neck.

10 8. The fuel filter according to claim 6,  
characterized in that the connection between the pump connection neck and the separate, unitary member is made by a process selected from the group consisting of glueing and welding.

15

9. The fuel filter according to claim 1,  
characterized in that the pump connection neck is injection molded onto the filter fabric.

20 10. The fuel filter according to claim 8  
characterized in that the pump connection neck is ultrasonically welded to the separate unitary member.

11. A fuel filter comprising:  
25 a) a supporting body comprising plastic;  
b) a filter fabric enclosing said supporting body;  
c) a pump connection neck positioned on the top side of the filter, the pump connection neck having an inlet opening surrounded by a plurality of supporting  
30 feet having spaces between them; and  
d) a plastic plate covering the inlet opening such that filtered fluid flows radially into the inlet of the pump connection neck through spaces between the supporting feet.

35

- 11 -

12. The fuel filter of claim 11 wherein the plastic plate comprises a disk.

13. The fuel filter of claim 12 wherein the disk is approximately the same size as the inlet opening of the pump connection neck.

14. The fuel filter of claim 11 wherein the plastic plate is sized and positioned to allow both axial and radial flow into the inlet of the pump connection.

FIG. 1

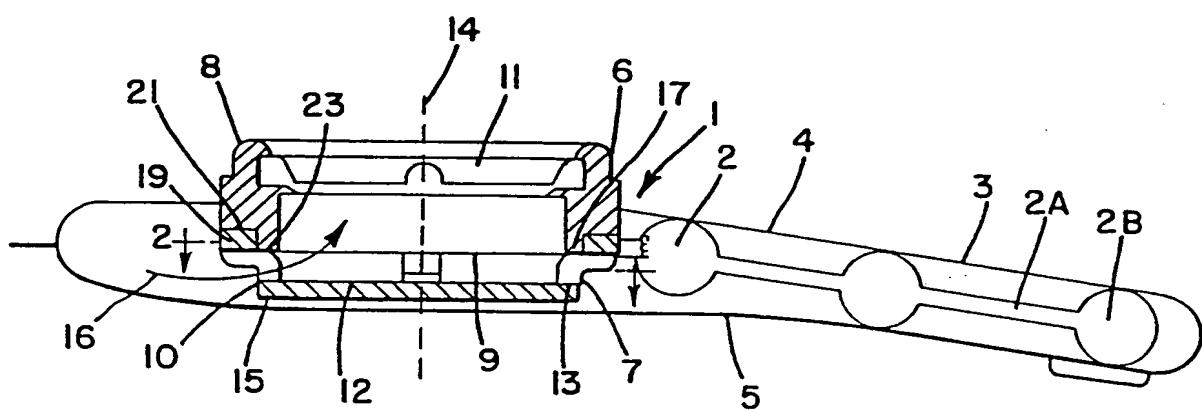


FIG. 2

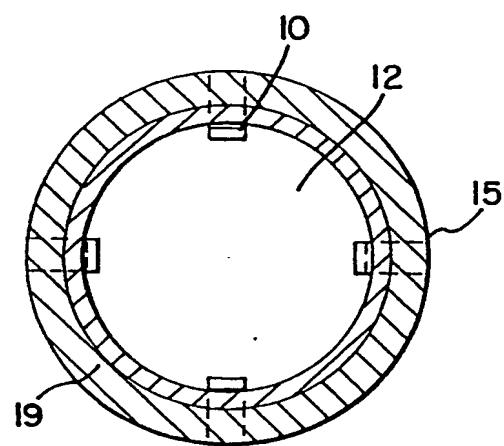


FIG.3

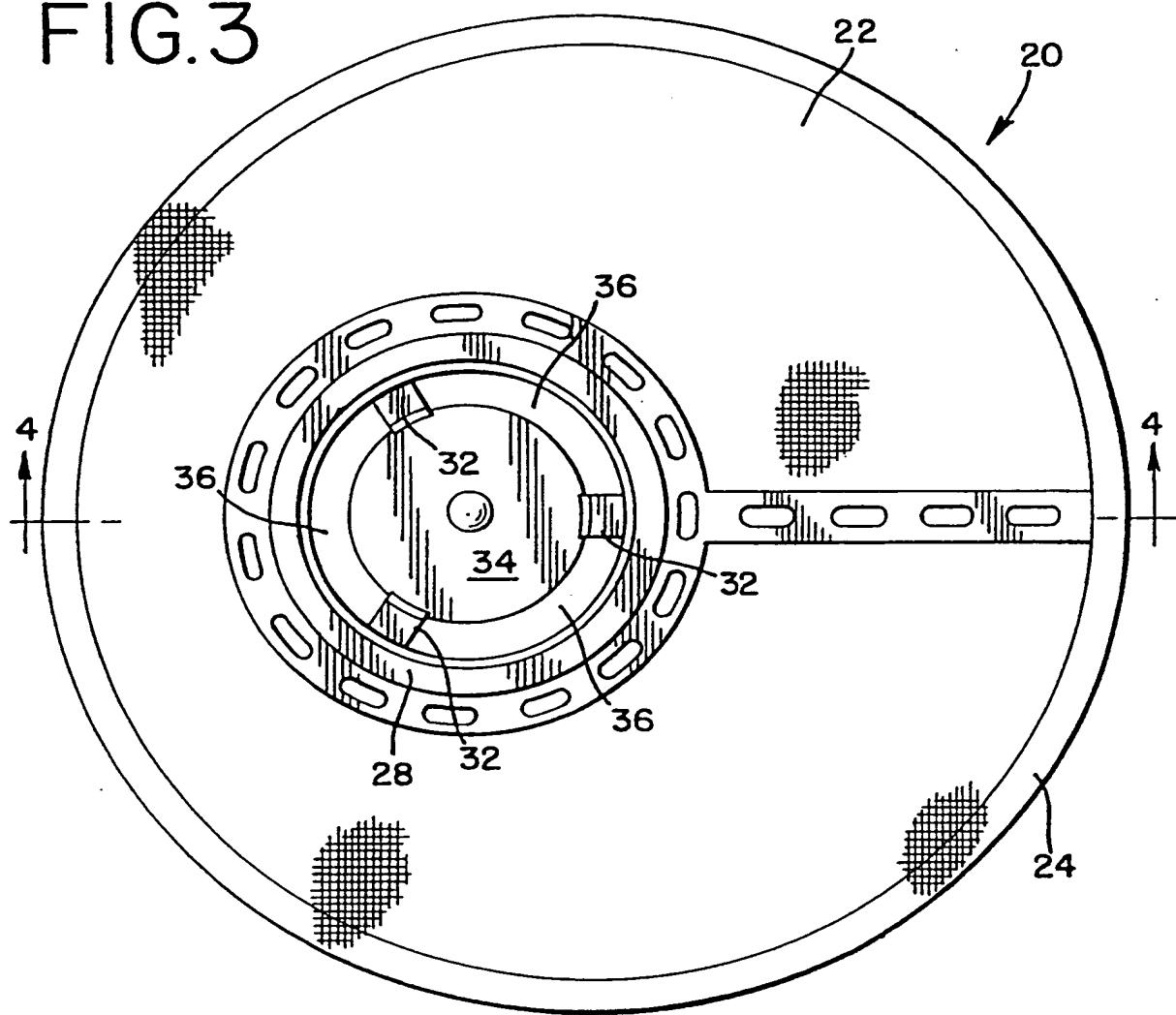
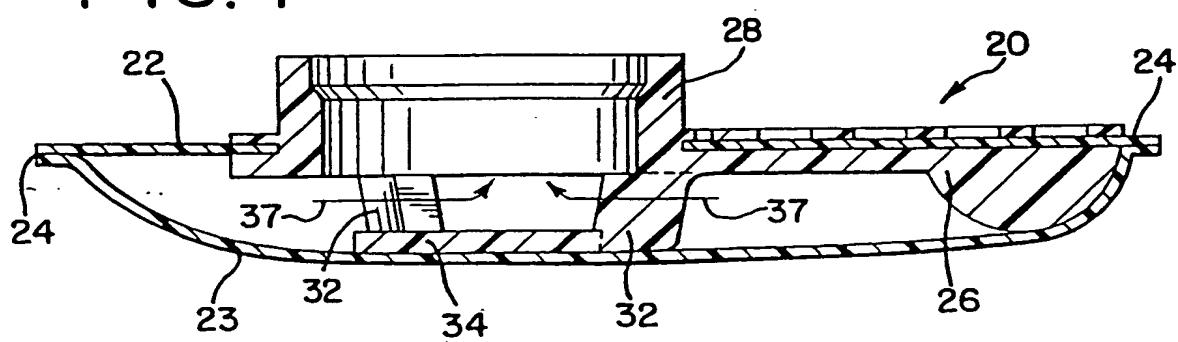


FIG.4





# INTERNATIONAL SEARCH REPORT

Internal Application No  
PCT/IB 97/00640

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 F02M37/22

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 F02M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 34 08 520 A (NISSAN MOTOR CO.) 6 September 1984 see page 6, line 18 - page 9, line 2; figures 2-5 ---	1-5,11, 12,14
X	US 4 420 396 A (YAMAMOTO ET AL.) 13 December 1983 see abstract see column 3, line 15 - column 4, line 62; figures 1-3 ---	1-3,6,7, 11-14
A	DE 295 18 501 U (FILTERTEK) 1 February 1996 see page 7, line 36 - page 8, line 5; figure 3 ---	9
A	US 4 961 850 A (COMBEST) 9 October 1990 see abstract; figure 6 -----	10

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

\* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

\*&\* document member of the same patent family

1

Date of the actual completion of the international search

Date of mailing of the international search report

12 September 1997

24.09.97

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl,  
Fax (+ 31-70) 340-3016

Authorized officer

Van Zoest, A

## INTERNATIONAL SEARCH REPORT

Information on patent family members

Internat. Application No

PCT/IB 97/00640

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 3408520 A	06-09-84	JP 1598696 C JP 2026060 B JP 59162354 A US 4561977 A	28-01-91 07-06-90 13-09-84 31-12-85
US 4420396 A	13-12-83	JP 1484269 C JP 57184408 A JP 63031249 B AU 8350382 A	27-02-89 13-11-82 23-06-88 11-11-82
DE 29518501 U	01-02-96	NONE	
US 4961850 A	09-10-90	US 5174841 A	29-12-92